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# Measuring motivation during self-paced exercise

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## Introduction

If physiological resources are of importance in endurance sports events, the manner in which athlete manages energy expenditure so that no factor will becoming limiting before the endpoint of exercise, named as pacing process, is a key factor determining performance.[1] It can be thought of as a complex process in which the athlete controls the intensity of exercise at any time by taking into consideration physiological reserves in relation to the estimated time until the finish at that exercise intensity.[1]

In this context, the role of effort is considered as of great importance, because as a muscle becomes fatigued, a progressive increase in the voluntary effort to enhance the facilitation system is added until the physical task requires a maximal effort.[2] Perception of effort is then considered as the conscious sensation of how hard, heavy and strenuous a physical task is[3] whilst potential motivation is the highest effort a person is willing to exert in order to succeed in a task.[4] But, other perceptual parameters could be used in order to include the role of motivation in pacing process in a more complete manner.

## The role of motivation in pacing process

Pacing process is a behavioral adaptation to the occurrence of fatigue during exercise.[1] In this context, motivation can be defined as the process that determines the direction and energization of this process.[5] Sports psychologists are able to determine the level of implication of intrinsic and extrinsic motivation in sport.[6,7] Unfortunately, most of these studies are designed in order to understand persistence or dropout behaviour, only to investigate the motives behind sport participation. No methods are designed to understand the reason of dropout behaviour or decreasing intensity during fatiguing exercise.

The most important problem is that the methods that are required to study the process of motivation are too long and complex to be used during exercise. For this reason, sport psychologists' just use the perception of effort in order to estimate the level of motivation and its evolution during fatiguing exercise.[5] It is important to democratize scientific tools that could be used during exercise in order to quantify the level of motivation during fatiguing exercise.

## Which psychological parameters to use?

Recent studies[8,9] quantified the desire to stop and the desire to pursue the exercise parallel to effort and pleasure by using adapted Borg scales.[10] It was proposed that the athlete monitors the difference between the difficulty of perceived effort and the pleasure during exercise. This difference is named as "affective balance" (AB). According to the authors, if the level of affective balance is near the high level of the maximal acceptance, the athlete must choose either comfort by reducing the exercise intensity or an increase in discomfort by maintaining the selected intensity in order to improve performance. To take into account this notion of internal conflict, the level of acceptance of AB could be defined as the difference between the desire to stop the exercise and the desire to continue.[1] This is in accordance with the principle of energy conservation.[5] The decrease of emotional reserve was defined as a diminution of average levels of pleasure, desire to continue and an increase of effort, affective balance and desire to stop during exercise.[8,9]

In this context, the motivation to pursue a fatiguing exercise is defined as the level of acceptance of effort. The more the motivation is, the more the level of consented effort is. On the contrary, when the motivation is down, subject would not support a high level of effort and his desire to continue for a given level of effort was decreased. Thus, the authors proposed using the ratio between the desire to continue and the perceived effort in order to estimate the level of motivation[9] rather than effort.[5] It was shown that this ratio decreased during exercise with the occurrence of fatigue. Moreover, this ration was lower and associated with a lower pleasure when a more important effort was asked whereas it was higher when the pleasure is higher. This ratio seems to be of interest in order to quantify the level of motivation to pursue a fatiguing exercise.

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## Conflict of interest

Author declares there is no conflict of interest in publishing the article.

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